4110 – SWITCHGEAR AND PROTECTION

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory		Practical Ex.	Total
4	-	4	25	-	3 Hrs	100	-	125

Pre-requisite	Source
4106	ELL

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	–	–	100

COURSE CONTENTS	Hrs	Mks
1. FAULTS Types of faults, three phase symmetrical faults and calculations of short circuit MVA for radial system only. Use of current limiting reactors.	5	8
2. FUSES Types and their characteristics & Selection	3	8
3. CIRCUIT BREAKERS Main function and requirement of circuit breaker, advantage over fuse. Theory of Arc interruption in A.C. and D.C. circuit, Basic principle of operation & constructional features of MCB, MCCB and ELCB. High voltage circuit breakers:- Constructional	18	32

feature and working of moving contact of ACB, Minimum oil C.B., ABCB, SF6 CB, vacuum CB, circuit breaker for HVDC application. Rating of circuit breaker, making and breaking capacity of contacts. General specifications of C.B.

4. PROTECTIVE RELAYS	16	20
Function of relay. Classification of relays, Construction working and field application of the following relays. Bimetallic relay, Bucholz relay, Induction relay (reverse power, over current & IDMT), Impedance relay, static relay – their introduction & block diagram for over current and differential protection.		
5. PROTECTIVE SCHEMES	22	32
Requirement of protective scheme, Definitions related with protective scheme – protective zone, Main and backup protection through fault etc.- Protective scheme for generation –unbalanced load phase faults, earth fault, field failure, over load (Merz price protective scheme and field suppression system), Protective scheme for transformer – Over current and earth fault protection. Percentage differential protection scheme, restricted earth fault. Connection of CTS for different connection of transformer winding. Unit Generator & transformer protection, Bus bar protection – for earth fault of single and double bus bar, transmission line protection, over current – Time graded, current graded, Time & current graded system (non directional). Distance protection – impedance relay, Translay balanced voltage protection using voltage/summation transformer, Principles of carrier current protection. Motor protection – protection against over current, over voltage, under voltage, single phasing, unbalanced supply voltage, differential protection, selection for particular type and rating of motor.		
Total	64	100

REFERENCE BOOKS:

1. Switchgear & Protection by Sunil Rao.
2. Power System Protection & Switchgear by Ravindranath M. Chander Wiley Easton.
3. Art & Science of protection Relay by Masan Wiley Easton.
4. Electric Power by S.L. Uppal.